Verbal Perseveration in Malayalam - English Bilinguals

Manju Mohan P.[1] & Swapna N.[2]

Abstract

The present study intended to investigate the nature of perseverations in Malayalam-English bilingual typical elderly individuals and compare the perseveratory errors between their languages viz. Malayalam, (their mother tongue), a language spoken by the native people of the state of Kerala, in South India and English which was acquired later in life. The study included twenty typical bilingual {first language (L1)-Malayalam and second language (L2)-English} elderly individuals and twenty age and gender matched monolingual (Malayalam speaking) elderly individuals within the age group of 60-80 years. The subjects were tested in two language conditions using the following five tasks: confrontation naming, generative naming, picture description, word definition and, question-answering. The audio recorded responses were transcribed and the data was subjected to appropriate statistical analysis. The results revealed significant lesser perseveration in bilingual individuals which highlighted the presence of cognitive advantage in the bilingual group. There was no significant difference between the type and frequency of perseverations across both languages of a bilingual. Further, no gender and age related differences were seen in perseveration. The study supports bilingualism as a type of cognitive stimulation. Also it extends support for the disinhibition account of perseveration as well as for the inhibitory deficit hypothesis of language and aging. The study implies the striking need for a deeper understanding of perseveratory phenomenon so as to reflect on the potential of this particular cognitive linguistic behavior as a sensitive cognitive linguistic measure.

Key words: bilingualism, verbal perseveration, cognitive advantage

Speech-Language Pathologists' (SLPs) in particular are concerned with the study of speech and language characteristics of elderly individuals as it has direct implications on clinically aging population. Speech errors such as verbal perseveration in specific, whether from normal or impaired speakers, provide data that reveals the nature of linguistic representations and the cognitive mechanisms underlying the production of words and sentences. Verbal perseverations are speech errors in which the flow of speech is disturbed by the intruding material that comes from the preceding speech. As defined by Sandson and Albert (1984) perseverations are the inappropriate recurrence or continuation of an earlier response.

Perseveratory errors reflect the malfunction of fundamental mechanisms of the normal language processor that can be disturbed by brain damage, by circumstances that stress the unimpaired language system in some way (e.g., increasing rate of speech), or by aging. This malfunction can operate at different levels of neurocognition to produce distinctly different kinds of perseverative symptoms. The most widespread taxonomy of perseveration classifies perseveration into continuous, stuck-in-set and recurrent types and implicates disturbances of adrenergic, dopaminergic and cholinergic neurotransmitter systems respectively. The descriptions of the different types of perseveration are provided in Table 1.

These neurochemical systems exert its effect on fundamental cognitive mechanisms that are thought to influence verbal perseveration, such as working memory, planning, shifting of cognitive sets and attentional processes. Thus perseveratory errors are expected in normal aging also, apart from brain damaged patients, as a result of decline in cognitive functions, specifically the executive functions. Changes in inhibitory control, component of executive function is the first to decline during cognitive aging (Bedard, Nichols, Barbosa, Schachar, Logan & Tannock, 2002). There are two different theories of perseveration namely the 'disinhibition theory' (Vitkovitch & Humphreys, 1991; Wheeldon & Monsell, 1994) and the 'underlying language processing breakdown theory' (Dell, 1986; Dell, Burger & Svec, 1997; Cohen & Dehaene, 1998). According to the disinhibition theory or competing activation account the residual activation from the prior response interferes with the person's ability to retrieve a new response from long-term memory because its representations have been recently activated. This activation interferes with activation of the current target, resulting in the erroneous and perseverative selection of the prime. While according to the underlying language processing breakdown or reduced language-processing efficiency account two vital components lead to perseveration: 1) weakened activation of a target at any processing level (e.g., semantic, phonological), 2) normally existing persistent activation from previous responses. In this sense, the persistent activation from a previous

[1]e-mail:manju.pranavam@gmail.com; [2] Lecturer in Speech Pathology, AIISH, Mysore, nsn112002 @ yahoo. com

Table 1. *Types of perseveration along with their description**

Type of perseveration	Motoric description	Areas of brain involved
Continuous	Abnormal repetition of a response token without cessation Stimulus: "Name this picture" (of a dog) Response: "Dog Dog Dog Dog"	Damage to thalamus, arcuate fasciculus and deep nuclei of subcortical structures Right hemisphere damage Norepinephrine depletion
Stuck-in-set	Inappropriate maintenance of a response type even though task demands have changed Stimulus: "Now point to the picture of the dog" Response: Continues to name, not point to, 'dog'	Left frontal lobe &/ mesolimbic frontal damage Dopamine depletion
Recurrent	Repetition of a previous response token to a subsequent stimulus within an established task set (Has pointed to dog and book) Stimulus: "Now point to the picture of the table" Response: Points to the 'dog'	Posterior left hemisphere damage, Left temporal/ parietal damage Acetylcholine depletion

*(Sandson & Albert, 1987)

response overcomes that of the target due to weakened activation of the target, rather than being due to interference from the previous response as earlier studies suggested.

There are two highly influential models proposed to explain these language changes during cognitive aging viz. the 'transmission deficit hypothesis' (MacKay & Burke, 1990) and 'inhibitory deficit hypothesis' (Hasher & Zacks, 1988; Hasher, Zacks & May, 1999). According to the transmission deficit hypothesis the weakened connection strength caused by disuse or aging produces transmission deficits that can impair activation, resulting in retrieval failure (Burke, MacKay, Worthley & Wade, 1991) while inhibitory deficit hypothesis states that older adults are less able to inhibit irrelevant information than young adults.

But it is not adequately explored whether these cognitive linguistic changes with definite underlying neural mechanisms affect the linguistic representations of both languages of a bilingual similarly or not. There are reports which suggest that the second language is learned through explicit memory while first language is acquired through implicit memory in late bilinguals (Paradis, 2004a). Under these circumstances, it can be assumed that, as different cognitive processes are involved in first and second language acquisition, there may be some differences in the underlying neural mechanisms of both languages of a late bilingual.

Research into bilingual language processing report bilingual advantages in nonverbal executive control in both children (Bialystok, 2001; Carlson & Meltzoff, 2008), and adults (Bialystok, Craik, Klein & Viswanathan, 2004; Bialystok, Craik & Ryan, 2006; Costa, Hernandez & Sebastian- Galles, 2008). This advantage has been attributed to the enhancement of executive processes through their constant involvement in the resolution of conflict between the two competing language systems, in bilingual language production. The extended experience of bilingualism thus builds up cognitive reserve and protects against the onset of dementia (Bialystok, Craik & Freedman, 2007).

It is presumed that perseveration may serve as a better behavioral tool to study second language changes during healthy aging as it has an implicated neurochemical substrata. The various neurochemical modulations have an effect on fundamental cognitive mechanisms particularly executive functions such as working memory, planning, shifting of cognitive sets and attentional processes which are thought to influence verbal perseverations. This offers the opportunity of considering perseveratory measures to assess bilingual cognitive advantages and to study whether these effects persists into old age. The current study also realizes the complete lack of any theoretical accounts or models proposed to study bilingual perseveratory behavior.

There is a lack of objective data concerning the nature and occurrence of perseverative behavior in the aging population. The study of perseveratory characteristics in the normal aging population would help an SLP to screen/evaluate geriatric clinical population for their speech and language deficits, if any. In treating the brain damaged population, there is no definitive 'cure' for perseverative errors till date. Thus the increased knowledge of the underlying nature of perseverative errors will assist SLPs in the treatment of this problematic symptom. Investigations to study perseveration have also raised diverse opinion on the

potential of the tasks that are used to elicit perseveration. Research in this direction may reveal the various underlying language mechanisms during aging and this may provide evidences to bridge the gap between the seemingly diverse theoretical accounts of perseveration as well as the cognitive models on language and aging by substantiating or contradicting the existing literature. Moreover, all the studies done so far, with respect to perseveration were in monolingual population. There is a pressing need to conduct similar studies in bilingual population as it may reveal interesting findings regarding the bilingual language representation, processing and bilingual cognitive advantages. It still remains unclear whether bilingual cognitive advantages persist into old age. Perseveratory errors may be used as a tool to examine this. Perseverations may also reflect language specific changes during healthy aging in bilingual elderly and research in this direction may also pave way into the less explored frontiers of second language loss. Keeping these in view, this study was planned. The specific objectives of the study were (1) to look for the type and frequency of perseverations if any, in bilingual normal elderly individuals and compare these with that of monolingual age and gender matched individuals to specifically examine the existence of bilingual cognitive advantage and (2) to compare the nature of perseveratory errors, in the first language, L1 (Malayalam) and second language, L2 (English) of Malayalam-English bilingual elderly speakers. In addition, the performance of the subjects with reference to age and gender was analyzed.

Method

The study included twenty normal bilingual elderly speakers (L1-Malayalam, L2-English) and twenty normal monolingual elderly speakers in the age group of 60-80 years. In each age group viz. 60-70 years and 70-80 years, ten monolingual and ten bilingual speakers were included with equal number of males and females in each group. The subjects had to satisfy a set of inclusionary criteria of which scoring in the "no cognitive impairment category" (severity score – 24 - 30) of Malayalam Mini-Mental State Examination, M - MMSE, (Mathuranath, Hodges, Mathew, Cherian, George & Bak, 2004) and obtaining a minimum score of '4' on each of the 4 macro skills in the International Second Language Proficiency Rating Scale (ISLPR) (Ingram & Wylie, 1997) on the second language proficiency for the Malayalam-English bilingual group were also considered. The subjects were tested individually in a quite environment in two language conditions (Malayalam and English) using five tasks viz. confrontation naming, generative naming, picture description, word definition and question-answering, so as to elicit perseveration. The materials under each of the tasks were selected from already published test materials. The responses were audio recorded, transcribed and analyzed for the type and frequency of perseverations. If perseverations were absent, a score of '0' was given and if perseverations were present, a score of '1' was given for each perseveratory utterance. The data was then compared for the frequency of perseveration for each subject on each task as a ratio which was finally converted to percentage using the following formula.

$$\text{Percentage of perseveration} = \frac{\text{Total number of perseveration X 100}}{\text{Total number of utterances}}$$

The total percentage of perseveration for each task was computed for each subject in a similar manner. The data were subjected to statistical analysis using SPSS (version 16.0 package).

Results and Discussion

The mean and standard deviation for each subject belonging to each language status (bilingualism and monolingualism) and each language condition (Malayalam and English) along with the type of perseveration were calculated. These results have been presented and discussed below under separate sections.

I. Comparison of perseveration between the groups:
a. Frequency of perseveration: The mean percentage of perseveratory errors and standard deviation across the groups of differing language status (bilingualism versus monolingualism), across two language conditions (Malayalam and English) and with respect to age and gender are depicted in Table 2.

The mean percentage of perseveration obtained for the bilingual speakers was lesser (M= 2.15, 2.25 in L1 and L2 respectively) compared to the monolingual speakers (M= 3.65). Two-way ANOVA revealed a significant difference in perseveration between both the bilingual and monolingual speakers ($F(1, 36) = 32.93$, $p<0.05$). The bilingual speakers had significantly lesser percentage of perseveration which could be because of the bilingual speaker's advantage in nonverbal executive control (Bialystok et al., 2004; Bialystok et al., 2006; Costa et al., 2008). Moreover, in individuals who are bi/multilingual, activation of lexicons are facilitated (Finkbeiner, Forster, Nicol & Nakamura, 2004), thereby gaining proficiency in both languages. Higher states of activation enhance accurate selection and thus diminish the chances of occurrence of perseveration or any other linguistic errors, thus supporting the results of the present study. The current finding also suggests that bilingual cognitive advantages persists even in the elderly individuals and

continue to influence changes in cognitive processing in bilingual older adults and supports that cognitive processing can be modulated by bilingualism.

Table 2. *Mean percentage of perseveration (M) and Standard Deviation (SD) with respect to age, Gender (G), language status (LS, Bilingualism Vs Monolingualism) and language conditions (LC, (Malayalam Vs English) for the bilingual and monolingual group*

*LS, LC & G	60- 70 yrs		70 - 80 yrs		Total	
	M	SD	M	SD	M	SD
BL1M	2.05	0.99	2.25	0.68	2.15	0.81
BL1F	2.08	1.08	2.24	0.59	2.16	0.82
BL2M	2.12	0.77	2.36	0.97	2.24	0.84
BL2F	2.18	0.85	2.35	0.71	2.26	0.74
ML1M	3.55	0.80	3.77	0.95	3.66	0.84
ML1F	3.54	0.68	3.74	1.03	3.64	0.83

*BL1M: Bilingual male - percentage of perseveration in L1; BL1F: Bilingual female - percentage of perseveration in L1; BL2M: Bilingual male - percentage of perseveration in L2; BL2F: Bilingual female - percentage of perseveration in L2; ML1M: Monolingual mal - percentage of perseveration in L1; ML1F: Monolingual female - percentage of perseveration in L1

Thus bilingualism can be considered as a life style factor that involves sustained complex mental activity which can add on to behavioral brain reserve/cognitive reserve and thus delay the rate of cognitive decline. This finding is in consonance with the studies by Bialystok et al., (2007), Rajsudhakar and Shyamala (2008) and Vijay Kumar and Prema (2010). Thus perseveration can be used as a behavioral measure to assess bilingual cognitive advantage.

The mean percentage of perseveration obtained in the study is also very less for both the groups (3.65% and 2.15% in L1, Malayalam for monolingual and bilingual speakers) compared to the significantly greater percentage of perseveration reported in the brain damaged population (Mukunthan & Prema, 2003). Ramage, Bayles, Helm-Estabrooks and Cruz (1999) concluded that in normal aging individuals the frequency of perseverations was less (4%) and a significant difference existed between normal elderly individuals and individuals with brain damage in terms of perseveration which can be used to differentiate both the groups. Chandralekha and Prema (2003) reported 3.6% of perseveration in the higher age group of 75-80 year old normal elderly subjects included in their study. Likewise Bayles, Tomoeda, Mc Knight, Helm-Estabrooks and Hawley (2004) also reported significantly less amount of perseveration in normal elderly speakers (8.5%) compared to persons with Alzheimer's Disease (30%). Preethi and Goswami (2010) in their study could elicit only 2.23% of perseveratory errors in normal elderly controls while in Alzheimer's Disease, the percentage of perseveration obtained was around 11.69%. Thus the perseveratory percentage obtained in the current study is comparable with the studies done previously in normal aging population.

b. Type of perseveration elicited: The type of perseveration seen in both languages of the bilingual and monolingual speakers in the current study was the recurrent type. There were no instances of continuous or stuck-in-set type of perseverations. But, there were reports of significant percentage of continuous type of perseveration compared to other types of perseveration in normal elderly Tamil speaking population in the study by Chandralekha and Prema (2003) and Mukunthan and Prema (2003). Preethi and Goswami (2010) reported of both continuous and recurrent types of errors in normal Malayalam speaking elderly. However, the results of the current study are in consonance with the study by Troster, Salmon, McCullough and Butters (1989) and Bayles, Tomoeda, McKnight, Helm-Estabrooks and Hawley (2004), in which only recurrent perseveration was seen during generative naming task. Thus it can be presumed that generative naming tasks may be more sensitive towards eliciting recurrent perseveration than other types of perseverations. The absence of other types of perseveration in the current study, could also be attributed to the strict inclusionary criteria used wherein the mental status of the subjects were screened using Malayalam version of Mini Mental State Examination (M-MMSE) before including them in the study. It is apparent from various studies that continuous and stuck-in-set types of perseveration are seen significantly in brain damaged population (Pekkala, Albert, Spiro & Erkinjuntti, 2008; Preethi & Goswami, 2010). Pekkala et al., (2008) studied Alzheimer's disease (AD) patients and reported that the different types of perseveration are likely to reflect the progressive deterioration of different brain regions. In their study with dementic patients, they could elicit recurrent and continuous perseverations in early stages of AD. As the disease progressed in severity into moderate stage, the number of recurrent and continuous perseverations increased and stuck-in-set perseverations emerged. According to Yamadori (1981) continuous perseverations are seen when there is a complete failure of post activation inhibition mechanism, and recurrent would reflect partial failure of that mechanism. It can thus be speculated that continuous and stuck-in-set perseverations may be reflecting more severe disruptions in post activation

mechanisms than the recurrent type. Thus the current study presumes that the different types of perseveration, recurrent, continuous and stuck-in-set falls into a continuum with recurrent appearing even with slight constraints over inhibitory mechanisms and stuck-in-set with more severe disruptions in inhibitory mechanisms.

Among the five different tasks employed, only generative naming task was found to elicit perseverative errors in both monolingual and bilingual speakers. The other tasks namely, confrontation naming, picture description, defining words and answering questions failed to elicit perseverative errors. This finding is in consonance with the findings reported by Bayles et al., (2004). According to them, the task difficulty influenced the rate of occurrence of perseveration. According to Craik (1986) the cognitive and language processes may vary according to changes in tasks, materials and strategies. Generative naming is a more difficult task as it assesses verbal fluency both letter and category. Generative naming requires actively searching for the lexicon in the semantic buffer, retrieving the target item and finally stating the names of the items rapidly (Bayles et al., 2004). Thus generative naming is likely to recruit additional processing mechanisms than just lexical retrieval including executive functioning and short term memory. Preethi and Goswami (2010) also reported that generative naming yielded highest mean percentage of errors, which occurred due to increased cognitive demands.

Confrontation naming of pictures was another task that was carried out. Here since the stimuli were presented visually, they provide a perceptual additional cue for the lexicon retrieval from the memory. According to Bayles et al., (2004) this cue offers increased activation in the semantic system and reduces the stress on the working memory during the retrieval. This plausibility explained as to why confrontation naming resulted in no perseverations. Similarly other tasks such as picture description and question and answer also required less effort as the subjects had sufficient time to recognize and generate ideas. According to Helmick and Berg (1976), the tasks that elicited the fewest number of perseverative responses were defining words and answering questions. These tasks were not bounded by speeded time conditions and thus may not have stressed the language system adequately to elicit perseverations. Rather enough time was given and the subjects were not constrained in any way to produce large number of ideas. Most often, it was observed that they enjoyed the freedom to limit their speech output. This would have affected their overall frequency scores (Bayles et al., 2004). In word definition tasks too, the subjects had the freedom to give any relevant responses, there were no time constraints or constraints regarding the number of alternate ideas that had to be produced. Even though this task tests divergent thinking of cognitive flexibility, the system may have still enjoyed the flexibility as no constraints were imposed over cognitive linguistic processing.

However, the finding of perseveration as being seen in only the generative naming task is in contrast to several other studies. In the Indian scenario, it contrasts the studies by Chandralekha and Prema (2003), Mukunthan and Prema (2003) and Preethi and Goswami (2010), wherein they could elicit perseveration in various tasks other than generative naming alone. This difference could be because of the subject selection criteria used in the present study; the subjects were screened for their mental status unlike the above mentioned studies. In such cases, it can be assumed that in order to elicit perseverations the language processing system needs to be highly constrained.

II. Comparison of perseveratory errors of L1 vs. L2 in bilingual speakers: In the bilingual group, the percentage of perseveratory errors with respect to the two different languages viz. first language (L1) and second language (L2) were analyzed. The mean values obtained were subjected to paired t-test. The mean and standard deviation values in both the languages along with the t-values obtained are depicted in Table 3.

Table 3. *Mean (M), Standard Deviation (SD) and t-value of percentage of perseveration for L1 (Malayalam) and L2 (English) in bilinguals*

Bilingual Group	M	SD	t-value(19)
First Language (L1)	2.15	0.80	0.424 (p>0.05)
Second Language (L2)	2.25	0.77	

The results of the paired t-test indicated that there was no significant difference in the percentage of perseverations between both languages for the bilingual speakers ($t(19) = 0.424$, $p>0.05$). Moreover, the only type of perseveration seen was recurrent perseveration in both languages of the bilingual. This finding supports the inhibitory deficit hypothesis of language changes with aging and the disinhibition account of perseveration since the perseverations in L1 were more or less similar to perseverations in L2. Inhibitory deficit hypothesis suggests deficient

inhibitory processes as contributing to cognitive linguistic changes during aging. According to the disinhibitory account of perseverations, the residual activation from the prior response interferes with the person's ability to retrieve a new response from long-term memory because its representations have been recently activated and thus cause perseverations. On the other hand, for the transmission deficit hypothesis and reduced language processing efficiency account of perseveration to have been true, there should have been significantly higher rates of perseverations in L2 compared to L1. This is assumed because there would have been reduced transmission to the linguistic representations of L2 due to less frequent use of second language in bilingual elderly which would then lead to weakened activation of the target words. Thus there are more chances for the persistent activation of previously uttered words to overcome the current target's activation levels, consistent with the reduced language processing efficiency account of perseveration, inducing greater perseveration in L2. But as the results did not reveal significant differences in the perseveratory patterns across both languages, the current findings extend support to the inhibitory deficit hypothesis of language and aging as well as to the disinhibition account of perseveration. The findings also support the conjectures put forth by Yamadori (1981) and Pietro and Rigordsky (1986) wherein failure of inhibitory mechanisms is implicated in causing perseverations. Thus from the current study it can be postulated that the changes in inhibitory functioning will affect the bilingual lexicons equally. That is the general cognitive decline associated with aging affects the two languages of a bilingual equally. In other words, the neural level mechanisms associated with general cognitive decline during aging affects the representation of both languages of a bilingual more or less similarly. However, in spite of the above findings, it is too premature to argue on lines of semantic degradation versus lexical access deficits of language representations in second language so as to conclusively postulate that there is no language specific loss/ attrition that are seen in bilingual elderly.

III. Effect of age on perseveration: The mean perseveratory errors for the monolingual and bilingual group were analyzed to examine whether any significant difference existed between the age groups. The data was subjected to Mann Whitney U test and the mean, SD and the /z/ values are shown in Table 4.

The combined mean (M) and standard deviation (SD) of all the participants in L1 for the two age groups viz. 60-70 years and 70-80 years were M=2.80 (SD=1.12) and M=3.0 (SD=1.19) respectively.

Table 4. *Mean (M), standard deviation (SD) with /z/ values for the two age groups for both groups*

*LS, LC & G	60- 70 yrs		70 - 80 yrs		/z/ value
	M	SD	M	SD	
BL1M	2.05	0.99	2.25	0.68	0.73
BL1F	2.08	0.08	2.24	0.59	0.10
BL2M	2.12	0.77	2.36	0.97	0.52
BL2F	2.18	0.85	2.35	0.71	0.31
ML1M	3.55	0.80	3.77	0.95	0.31
ML1F	3.54	0.68	3.74	0.03	0.21

*LS- Language status, LC-Language conditions, G-Gender

Similarly the combined mean and standard deviation of all the participants for the two age groups in L2 were 2.14 (SD=0.76) and 2.35 (SD= 0.80) respectively. The results of the Mann Whitney test showed no significant difference between various age groups across any of the variables. This particular finding is not in consonance with the studies which have reported an age effect on perseveratory errors such as Troster et al. (1989), Daigneault, Braun and Whitaker (1992) and Chandralekha and Prema (2003). But support can be drawn for the current findings from the studies done by Ramage et al. (1999) and Foldi Helm-Estabrooks, Redfield and Nickel (2003), in which they report no age effect on verbal perseveration. As in the study by Ramage et al. (1999), the current study also assessed mental status before including the subjects for testing. Thus the lack of any age effect may be because of the confirmation of absence of pathological cognitive impairment by screening the participants using M-MMSE before including them in the study, which was not carried out in the above mentioned opposing studies. Moreover, the factors of personality, literacy, educational history etc. could be some other factors contributing to this finding. Schooling has also been reported to improve cognitive functioning (Garcia & Guerreiro, 1983; Roselli, Ardila & Rosas, 1990). Socioeconomic status and cultural factors also play a significant role in literacy and cognition (Reis & Castro-Caldas, 1997). Another factor that may play a role would be social engagement, which is defined as the maintenance of many social connections and a high level of participation in social activities and this has been thought to prevent cognitive decline in elderly persons (Bassuk, Glass & Berkman, 1999). It's apparent that today's older people are much likelier to have had more formal education, higher economic status, and better care for risk factors such as high blood pressure, high cholesterol and smoking that can jeopardize their brains. These results are significant especially in the Indian context for prevention of age related

communication disorders. The findings are in consonance with the study by Vijay Kumar and Prema (2010) wherein the authors attribute extraneous variables such as linguistic exposure i.e., bilingualism, life style, culture, profession, physical and communicational activity, physical and mental exercises, dietary habits etc. to the prevention of cognitive rigidity in elderly. Thus the absence of any age effect on the frequency of perseveration may be because of the above mentioned factors which might be contributing to lesser cognitive decline in elderly.

IV. Effect of gender on perseveration: The results of two-way ANOVA revealed no interaction effects between language status and gender [$F(1, 36) = 0.002$, $p>0.05$]. Moreover, there was no significant difference between both genders [$F(1, 36) = 0.00$, $p> 0.05$] in L1. An independent t-test was used to analyze gender effects in second language, L2 (English). The results revealed that there was no difference between males and females even in L2 ($t(18) = 0.068$, $p>0.05$). Thus, on the whole, there was no gender difference that could be found in the current study with respect to the percentage of perseveration. The absence of any gender effect in the current study is not in agreement with the study in Indian Tamil population by Chandralekha and Prema (2003), while it is in consonance with the study by Ramage et al., (1999).

Studies discussing gender differences in cognitive functions report that women perform at a substantially higher level than men on verbal production, episodic memory, and face recognition tasks while men perform at a higher level on visuospatial tasks. The reasons speculated for these differences include variations in the sex hormones, socio-cultural factors, educational factors, training etc. (Weiss, Kemmler, Deisenhammer, Fleischhacker & Delazer, 2003; Herlitz & Lovén, 2009). A study by Mohan and Shyamala (2009) on the development of stroop effect in bilinguals also showed a substantial difference in the performance between males and females where females outperformed males. But the authors also report that there was an absence of gender effect after the age of 60 years due to the general cognitive decline nullifying the still debated female advantage in language processing. Thus the same explanation can be reasoned out for the absence of gender differences in the present study.

In sum, the results of the present study revealed that bilingual speakers showed significantly less perseveratory errors compared to the monolingual speakers highlighting the bilingual cognitive advantage. The present study revealed only recurrent perseverations in healthy aging population which indicates that tenably the various types of perseveration falls into a continuum wherein recurrent perseverations are elicited even with minimal disturbances to language processing system whereas stuck-in-set perseverations are obtained only if the system is severely disturbed. The findings also suggest similar nature of perseveratory errors in both languages of bilingual speakers which permits to foresee that both languages of a bilingual may be equally vulnerable to the general cognitive decline associated with aging. Further, there were no age or gender effects on the frequency of perseveration.

Conclusions

It can be concluded from the study that perseveration is a cognitive linguistic behavior with a neurophysiological basis and reflect deficits in executive functions. The current study extends its support to the disinhibition account of perseveration as well as to the inhibitory deficit hypothesis of language and aging since no significant difference was found between the two languages of bilingual speakers. Moreover, the conclusions drawn from the current study is corroborated with the previous studies, wherein the task difficulty is suggested as a factor which determines the nature of perseveratory errors. The study proposes generative naming, as the most useful task to elicit perseverations, particularly in individuals with adequate cognitive reserve.

The current study adds evidence to the literature that supports bilingual cognitive advantage and its persistence to old age by using behavioral data on perseveration and highlights the use of perseveratory measures for assessing bilingual cognitive advantage. It also highlights the importance of cognitive stimulation which can delay the devastating effects of cognitive impairments.

The study assumes that the general neurocognitive changes seen during aging affect the linguistic representations of a bilingual similarly giving some insight in to the less explored frontiers of second language loss in healthy elderly bilinguals, which is a fertile area where research is heavily warranted. The study also has implication with respect to intervention strategies for treating perseveration. Nevertheless, the results of the present study have to be interpreted with caution as the findings are concluded on the basis of the data obtained from a single task (generative naming) which was used for eliciting perseveration. Moreover, there was limited number of subjects within each age group.

More systematic and in depth analysis of perseveration especially in terms of its linguistic description is recommended especially in bi and multilingual population so as to elaborate on the currently accepted models on language processing.

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